# COCONINO COUNTY PUBLIC WORKS DEPARTMENT
# PAVING STANDARDS

All paving shall be placed and tested in accordance with this section, unless otherwise stated by the County Engineer or his/her representative. Upon completion of the paving project, the project engineering firm must submit a *report* to the County Engineering Department. The report shall comply with the subheading in this section titled *"reports"*.

The following standards shall be considered the minimum standards to be used on Coconino County paving projects. Additional recommendations and specifications may also be incorporated for construction if stated in a project engineering report, or as shown on the project plans.

## Asphaltic Concrete Paving

The contractor shall be responsible for producing, transporting, and placing pavement and all related materials, in conformance with this section. All work performed, and material used shall be warranted from defect by the contractor for a period of 1 year from the date of final acceptance of the project. Any work necessary to repair damaged or failing areas shall be performed wholly at the contractor's expense, with the repairs made in a timely manner, as determined by the County Engineer.

***General*** Asphalt (asphaltic concrete) may only be placed when the ground or existing **surface temperature is $45^{0F}$ or greater**. If at anytime during the laydown or compaction operation the temperature of the asphalt is deemed to be cooling down to quickly, or unevenly (either due to weather, transport, or other reasons), the engineer or his representative may suspend the paving operations until adverse conditions have changed, or are corrected. Immediately prior to being placed, the asphalt shall be in a thoroughly mixed condition; free of lumps, crusts, coarse or fine pockets of material, and in a free flowing , workable condition.

All asphalt shall be placed by means of self propelled paving machines, except when placing hot mix for trench patches. Pavers shall be equipped with an activated screed for the full width being paved, and heated if necessary.

Pavers shall be equipped with automatic screed controls, with sensors for both sides of the paver, capable of sensing grade from an outside reference line. The automatic controls must be able to sense the transverse slope of the screed, and providing automatic signals which control the screed to maintain the desired grade and transverse slope.

Immediately prior to paving, the exposed surface to receive asphalt shall be free of loose material, moisture, dust and debris, and then tacked with SS-1 asphalt emulsion.

***Mix Design*** The contractor will hire an engineering laboratory to develop the necessary mix design. The engineering laboratory shall hold current accreditation by AMRL, as described in this section under the subheading "Sampling and Testing of Pavement and Related Materials". The mix design (**for design purposes only**) shall conform to the criteria and requirements listed as **Table 1**, in this section (ADOT 416 mix). **The mix design must be submitted for review to the County Engineering Department at least one month prior to paving.** After acceptance by the County, subsequent changes to the mix design may only be made with the approval of the County Engineer.

**TABLE 1 Mix Design Requirements**

| Criteria | Requirements | | | Arizona Test Method |
|---|---|---|---|---|
| | ½" Mix | 3/4'~ Mix | Base Mix | |
| 1.Voids in Mineral Aggregate: %, Range | 15.5 - 18.5 | 15.0 - 18.0 | 14.5 - 17.0 | 815 |
| 2. Effective Voids: %, Target (±1) | 3.5 | 3.5 | 3.5 | 815 |
| 3. Absorbed Asphalt: %, Range | 0-1.0 | 0 - 1.0 | 0-1.0 | 815 |
| 4. Index of Retained Strength: %, Minimum, Note | 70 | 70 | 70 | 802 |
| 5. Wet Strength: psi, Minimum | 150 | 150 | 150 | 802 |
| 6. Stability: pounds, Minimum | 2,000 | 2,000 | 3,000 | 815 |
| 7. Flow: 0.01-inch, Range | 8 - 16 | 8 - 16 | 8 - 16 | 815 |
| 8. Mineral | Aggregate Grading Limits | | | 201 |

| Sieve Size | Percent Passing | | | | | |
|---|---|---|---|---|---|---|
| | ½ inch Mix | | 3/4 inch Mix | | Base Mix | |
| | No Admix. | Includes Admix. | No Admix. | Includes Admix. | No Admix. | Includes Admix. |
| **1-1/4 in.** | | | | | 100 | 100 |
| 1 inch | | | 100 | 100 | 90 -100 | 90 - 100 |
| 3/4 inch | 100 | 100 | 90 - 100 | 90 - 100 | 85 - 95 | 85 - 95 |
| 1/2 inch | 90 - 100 | 90 - 100 | --- | --- | --- | --- |
| 3/8 inch | 67-82 | 67-82 | 62-77 | 62-77 | 57-72 | 57-72 |
| No. 8 | 40 - 48 | 41 - **49** | **37** - 46 | 38 - 47 | 32 - 42 | 33 - 43 |
| No.40 | 10-18 | 11-19 | 10-18 | 11-19 | 8-16 | 9-17 |
| No. 200 | 1.5 - 4.5 | 2.5 - 6.0 | 1.5 - 4.5 | 2.5 - 6.0 | 1.5 - 3.5 | 2.0 - 5.0 |

Note: The Asphalt Content (%bitumen) shall be 6.0 (±1)

***Tack Coat*** Asphalt binder shall be **SS-1** type emulsion, unless otherwise specified by the County Engineer.

***Asphaltic Concrete Friction Course (ACFC)*** The materials and mix design for **ACFC shall conform to ADOT section 407 unless otherwise stated herein**, or approved by the County Engineer. **ACFC shall only be placed when the surface temperature is 65$^{oF}$ or greater.**

Immediately prior to paving, the exposed surface to receive asphalt shall be free of loose material, moisture, dust and debris, and then tacked with SS-1 asphalt emulsion.

Acceptance will be determined in accordance with the "Final Acceptance" section under these standards.

***Asphalt Production*** The contractor shall be responsible for hiring a qualified manufacturer and supplier for all asphaltic products. It is the contractor's responsibility to assure that the materials produced and supplied by the plant conform to the project specifications.

***Placement and Compaction*** All pavement must be **placed and compacted in two equal layers**, unless otherwise directed by the County Engineer. The upper layer shall not be placed over the lower layer until the temperature of the upper layer has dropped below $115^{o}F$. **The temperature of the asphalt shall not exceed $325^{o}F$** upon discharge from the laydown machine. If the second layer of asphalt is being placed within 8 hours of the first layer, no asphalt binder shall be necessary, as long as the surface of the lower layer remains clean.

**All compaction of the asphalt shall be performed by static rolling,** and shall fall within the *"Rolling Pattern Guidelines"* listed in this section, unless otherwise approved by the County Engineering Department. Adjustments within the rolling pattern guidelines will be determined by the use of a nuclear gauge. The nuclear gauge will be used to determine the "break-over" point of the asphalt (as determined by the highest wet density reading of a nuclear gauge) to help guide in the number of passes necessary per rolling sequence. A pass shall be considered "one coverage" by the roller in one direction.

**Rolling Pattern Guidelines**

| *Rolling Sequence* | *Compactor Type* | *Temperature* | *N$^{o}$ of Passes* |
|---|---|---|---|
| ➢ Breakdown | 8 ton steel drum (min)[1] | $250^{o}F$ to $325^{o}F$ | 1 to 2 |
| ➢ Compaction | Pneumatic Tired Roller[1,2] | $175^{o}F$ to $250^{o}F$ | 3 to 6 |
| ➢ Finish | 8 ton steel drum (min)[1] | $115^{o}F$ to $175^{o}F$ | 2 to 4 |

[1] A combination steel drum/rubber tired roller may be substituted with County Approval

[2] Min 4 ton pneumatic roller, with overlapping tires - inflated to manufactures max psi

Note: A "vibra plate" may not be used to compact asphalt, only equipment approved by County Engineering Department shall be used.

Once an acceptable rolling pattern has been determined, the contractor shall not vary from it unless monitoring by the project engineering firm suggest differently. The engineering firm's field technician shall regularly monitor the rolling/compaction operation, and as necessary, recommend rolling pattern change. It shall be the project engineering firm's responsibility to monitor and document the rolling/compaction operation, and then present their observations in the final project report. Acceptance of compaction by the County will be based whether the contractor placed the asphalt within the parameters of the *rolling pattern guidelines*, as listed in this section.

***Method of Measurement*** Asphaltic Concrete and ACFC will be measured by the ton. Measurement will include the weight of all materials transported to the job and placed as hot mix. Tickets must be provided to the County for all products delivered to the project. Tickets shall include:

- Plant or manufacture name and location
- Project name, and location of delivery
- Date of delivery
- Time of arrival at site
- Weight of material (by ADOT approved scale)
- Truck number or license
- Driver name
- Signature by the Contractor's representative acknowledging receipt of the product

***Basis of Payment*** Asphaltic Concrete will be paid for based on ticket weights and contract price per ton. No other payment will be made for individual items, such bituminous material, mineral admixture, or tack coat; these items will be considered as part of the unit price for asphaltic concrete. No variance shall be made from the method of measurement or the basis of payment without agreement by the County Engineer.

***Quality Control*** The contractor shall hire an engineering laboratory to sample, test, and document the paving operation; from mix design to final placement (QC). It is the project engineering firm's responsibility to communicate results to the contractor in a timely manner. The QC laboratory shall pull a minimum of **1 cold feed (belt sample) per day.** This sample shall be tested in accordance with ADOT sections 416-7.01 and 416-7.02.

**A minimum of two hot asphalt samples shall be taken during a day's placement** by the QC laboratory. Should a day's placement exceed 1000 ton, 1 more sample for each subsequent 500 ton shall be taken by the QC laboratory.

All test results shall be completed in a timely manner. When samples are pulled in the morning, results shall be made available to the contractor and the County by early afternoon; for material sampled in the p.m., test results shall be made available the following a.m., unless otherwise agreed upon with the County in advance.

The contractor shall stop their paving operation when they are informed by the engineering lab of out of spec material, and shall not resume until the material is shown to the County to be back within project specs. The engineering lab shall submit all testing, sampling, and field observation documentation to the County Engineering Department, as specified in the subheading in this section titled *"reports"*.

The County Engineering Department reserves the right to hire an engineering laboratory of their choice to perform quality assurance (QA); including mix design review, and the sampling or testing of the asphalt and materials, either at the plant and/or during placement. Materials not meeting project requirements will be rejected. Unacceptable materials shall be removed immediately, unless the County Engineer agrees to other arrangements.

## ***Sampling and Testing of Pavement and Related Materials***

All sampling procedures for pavements and related materials shall be performed in accordance with current ASTM standard test methods, unless otherwise approved by the County Engineer or noted below. **Laboratory testing, field sampling and testing, and inspection or observations, shall be performed by ATTI or NICET personnel only**, unless otherwise approved by the County Engineering Department. **All Engineering laboratories performing work on Coconino County projects shall hold current accreditation by AMRL as an approved AASHTO-R18 Lab.**

## Accepted Test Methods are:

### ***Field***

| | |
|---|---|
| Density by Nuclear Gauge (Backscatter/Thin Lift only) | D2922 / 4.08 |
| Standard Practice for Sampling Aggregates | D75 / 4.03 |
| Standard Practice for Sampling Paving Mix | D979 / 4.03 |
| Sampling Bituminous Materials | D140 / 4.03 |
| Random Sampling of Construction Materials | D3665 / 4.03 |
| Pavement Condition Index (PCI, Failure Types) | D5340 / 4.03 |
| Pavement Condition Index (PCI, Condition/Deduct Value) | D6433 / 4.03 |

### ***Lab***

| | |
|---|---|
| Standard for Hot Mixed / Laid Paving | D3515 / 4.03 |
| Marshall Stability / Unit Weight | T 245 / 2B |
| Maximum Theoretical Unit Weight (Rice) | D2041 / 4.03 |
| Bulk Specific Gravity (Water Bath) | D2726 / 4.03 |
| Bulk Specific Gravity (Wax Coated) | D1188 / 4.03 |
| Bulk Specific Gravity (Vacuum Sealing) | D6752 / 4.03 |
| Specific Gravity of Coarse Aggregates | C127 / 4.02 |
| Specific Gravity of Fine Aggregates | C128 / 4.02 |
| Abrasion of Small Aggregate (L.A. Abrasion) | C131 / 4.02 |
| Abrasion of Large Aggregate (L.A. Abrasion) | C535 / 4.02 |
| Sieve Analysis of Aggregates | C136 / 4.02 |
| Size Analysis of Extracted Aggregates | D5444 / 4.03 |
| Sieve Analysis of Mineral Filler | D546 / 4.03 |
| Sand Equivalent (SE) | D2419 / 4.03 |
| Extraction of Bituminous Materials | D2172 / 4.03 |
| Asphalt Content by Nuclear Method | D4125 / 4.03 |
| Asphalt Content by Abson Recovery | D1856 / 4.03 |
| Asphalt Content by Ignition Oven | D6307 / 4.03 |
| Coating and Stripping of Bitumen Aggregate | T182 / 2A |
| Degree of Particle Coating of Bituminous Mixtures | D2489 / 4.03 |
| Moisture or Volatile Distillates of Asphalt | D1461 / 4.03 |
| Viscosity of Asphalts by Viscometer | D2171 / 4.03 |
| Performance Graded Asphalt Binder (PG) | MP 1a / Prov. Stand. |
| Compressive Strength of Bituminous Materials | D1074 / 4.03 |
| Effect of Water on Compressive Strength | D1075 / 4.03 |
| Effect of Moisture on Tensile Strength | D4867 / 4.03 |
| Percent Air Voids in Bituminous Mixtures | D3203 / 4.03 |
| Prep. By California Kneading Compactor | D1561 / 4.03 |
| Resistance by Hveem Apparatus | D1560 / 4.03 |

***Reports*** Upon completion of a paving project, an engineering report shall be submitted to the County Engineering Department. This engineering report shall be signed by a registered civil or geotechnical engineer, or a NICET Level IV technician. Included in the report shall be:

- **A description of the project**
- **All laboratory and field test results**
- **A plot plan, showing areas paved or other work.**
- **Indication if the project was completed per project specifications, or whether any unacceptable material or work remains, if so, specify.**

**All reports shall be submitted to the County Engineering Department within 30 days after the completion of construction.** At the request of the County Engineering Department, daily field reports, lab reports, or other information, may be requested during the construction of a project

## *Final Acceptance*

The asphalt surface shall be visually free of:

- Segregated zones (areas with too many fines or coarse material)
- Cracking (alligator or loose areas)
- Bumps or Sags
- Corrugation
- Any other areas that will cause shortened asphalt life, or increase the roughness of ride.

**The following methods shall be used to determine final acceptance, unless otherwise approved by the County Engineer**:

- **Profilometer** Smoothness Survey, or **Road Surface Profiler** capable of translating measurements into the **International Smoothness Index (IRI).** This method shall be used for paving projects in excess of 1 mile in length. Any pay factors shall be included in bid and contract documents.
- A **water truck** may be utilized to pour water across the finished pavement, any areas that puddle deeper than ¼" within a 10' area shall be repaired by a method acceptable to the County.
- For paving projects with straight runs of less than 1 mile, such as residential areas, the **Pavement Condition Index (PCI), per ASTM D6433/4.03** shall be used. New pavement found to have areas designated L, M, or H (per Appendix X1) shall be repaired by the contractor before the job is accepted as complete.
- The final surface course of asphalt **shall not vary more than ¼"** with a 10' straight edge placed any direction on the asphalt surface.
- **No payment shall be made for unacceptable materials** or material not conforming to project specifications.
- **E**dge of **P**avement **shall not deviate more than 1"** from a straight edge.

***Safety*** During the construction process, all applicable "OSHA Standards for the Construction Industry" shall be followed, including (but not limited to) 29 CFR Part 1926, Subpart P – Excavations. All construction equipment and materials shall be safely fenced off from public access during the entirety of the project.

Knowing and following OSHA Safety Standards is the contractor's responsibility. The County may stop construction on a project until safety concerns have been corrected.

***Dust Control*** Dust and airborne particulate must be safely limited in all areas that a contractor is performing construction, or where equipment is driven to access the work area. Existing paved roadways, driveways, and other paved/concrete areas must be washed or swept free of dirt and debris daily, or as necessary.

The County may stop a project until dust and debris have been properly controlled.

***Traffic Control*** Within all residential areas, and other County roadways, flaggers and construction warning signage shall be used during all construction, unless otherwise approved by the County Engineering Department. Flaggers shall be equipped with radio communication when not in full view of each other. Pilot vehicles used during paving and other roadway projects shall be clearly marked, be equipped with warning lights, and be in radio communication with flaggers at each end of the traffic control area.

Traffic control shall be maintained in accordance with the Manual on Uniform Traffic Control Devices (MUTCD), which is published by ATSSA/ITE/AASHTO, and approved by USDOT and the Federal Highway Administration (current edition).

**A temporary traffic control plan shall be submitted to the County a minimum of 30 days prior to the commencement of any roadwork** (or construction, where the contractor may be crossing the roadway with equipment during construction). The temporary traffic control plan shall conform to Part 6 – Temporary Traffic Control, in the MUTCD.

It is the contractor's responsibility to comply with the temporary traffic control plan. The County may stop construction on a project until traffic safety concerns have been corrected.

All permanent signage shall be placed per the project plans and conform to MUTCD, unless otherwise approved by the County Engineer. **All newly paved County roadways shall have Fire Hydrant Markers installed per the following guidelines:**

- Each fire hydrant shall be equipped with a 60" side mount reflective marker, as approved by the County Engineering Department
- A blue reflective marker shall be inset into the roadway 6" off of center towards the fire hydrant side. If the hydrant is at an intersection, there shall be a marker placed for both roadways.

Dale Wegner, P.E.
County Engineer

Tim Davis
Construction Supervisor

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